Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Request by Metrom Rail, LLC	)	WT Docket No. 18-284
for Waiver of Sections 15.519(a) and	)	
15.519(c) of the Commission's Rules	)	

REPLY COMMENTS OF METROM RAIL, LLC

On September 4, 2018, Metrom Rail, LLC (Metrom) filed a request for waiver of Sections 15.519(a) and 15.519(c) of the Federal Communications Commission's ("Commission") rules to permit: (1) Metrom to obtain a grant of equipment authorization for an ultrawideband ("UWB") positive train control ("PTC") system in the 3.272-5.014 GHz band that operated above the current radiated power emissions limit for some limited cases where a directional antenna is necessary; and (2) Metrom and rail authorities to install and operate the AURA PTC System as fixed wireless infrastructure under the handheld UWB device rules.[1] On September 20, 2018, the Commission's Office of Engineering and Technology ("OET") placed the Waiver Request on public notice and established an October 22, 2018, deadline for filing initial comments.[2]

The Public Notice generated overwhelming support. Metrom respectfully submits that the lack of any substantial opposition illustrates the non-controversial nature of the Waiver

[1] *See* Request by Metrom Rail, LLC for Waiver of Sections 15.519(a) and 15.519(c) of the Commission's Rules (filed September 4, 2018) ("*Waiver Request*").

[2] Office of Engineering and Technology Seeks Comment on Metrom Rail LLC Request for a Waiver of Part 15 Ultrawideband Rules for a Positive Train Control System, DA 18-973, September 20, 2018 ("*Public Notice*").

Request and thus clears the way for its expedited processing and approval. The record before the Commission demonstrates that granting Metrom's request will improve public safety and serve the public interest by enabling PTC to be deployed to public transit and short rail train systems in a cost effective and accurate manner. As noted by commenters, the requested waiver would serve the public interest by: (1) allowing for safer train operations both for the operators and civilian occupants; (2) permitting more efficient train operations without sacrificing public safety; and (3) reducing the costs associated with implementation of positive train control – thereby increasing the availability of such systems.[3]

As fully described in the Waiver Request, Metrom's AURA PTC system solves many of the drawbacks of more traditional approaches because of its reliance upon relatively low cost unlicensed UWB devices that allows for a less expensive and more rapid implementation to protect the train riding public.[4] The AURA system has been installed in over 3,000 vehicles throughout the U.S. and Canada, with no registered complaints of harmful interference.[5] While the Commission's rules allow for use of the AURA system, certain minor enhancements to allow for the use of fixed devices and directional antennas require waivers of the existing Part 15 rules. The Commission's rules require that all UWB devices be hand held and not employ a fixed

[3] *See e.g.*, Comments of Dataspeed Inc., OET Docket No. 18-284, (filed Oct. 12, 2018); Comments of IBM, OET Docket No. 18-284, (filed Oct. 18, 2018); Comments of Adaptive Motion Group, OET Docket No. 18-284, (filed Oct. 22, 2018); Comments of iTrack, LLC, OET Docket No. 18-284, (filed Oct. 22, 2018); Comments of Proterra Inc., OET Docket No. 18-284, (filed Oct. 22, 2018).

[4] *Waiver Request* at 4.

[5] *Id.* at 5.

infrastructure.[6] Use of directional antennas would have the effect of increasing the EIRP by 6 dB above the Commission's regulations.[7] Neither of these changes would increase the risk of harmful interference to other parties.[8]

In addition, grant of Metrom's Waiver Request would allow regional and local rail authorities in Boston, New York, and Los Angeles (as well as other cities in the country in the future) to implement all the functionality possible to prevent train-to-train collisions, derailments, to protect workers, and to guard against operational errors.[9] Indeed, both Boston and New York have had successful demonstrations of the AURA PTC system that included red signal overruns, collision avoidance, and speed limit compliance (among other tests) and have resulted in no reported instances of harmful interference caused to any authorized radio system.[10]

The sole opposition to Metrom's Waiver Request was raised by The Aviation Spectrum Resources, Inc. ("ASRI").[11] ASRI requests that the Waiver Request be put on hold until its concerns about harmful interference to aviation safety systems are addressed.[12] ASRI has requested a variety of additional technical information (transmit power and signal characteristics, fixed station installation data, density of transmit systems, proximity to airports, duration of

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[6] *See* 47 C.F.R. § 15.519(a).

[7] *Id.* at 10-20. *See also* 47 C.F.R. § 15.509(d).

[8] ***Waiver Request*** at 13-14; 17-20.

[9] *Id.* at 1.

[10] *Id.* at 8-10.

[11] Comments of Aviation Spectrum Resources, Inc. ("ASRI"), OET Docket No. 18-284, (filed Oct. 22, 2018) ("ASRI Comments").

[12] *Id*. at 4.

operations, and use of other chipsets/waveforms), as well as the identification of a "stop buzzer" contact point that could be called in the event of harmful interference.[13] It also suggests that it would be "reaching out directly" to Metrom to discuss these issues.[14]

Initially, Metrom would note that ASRI's concerns were generally addressed in its Waiver Request. The AURA PTC system, with the exception of the cases where directional antennas are used in accordance with the Waiver Request, would comply with all UWB technical rules, such as the EIRP limit, the OOBE limits, ceasing transmission if there is no acknowledgement from a receiver, etc.[15] Mobile transmitting stations will be located on the rail trains and fixed responding stations will be located at wayside locations along the train tracks.[16] However, to assuage any concerns of ASRI, Metrom provides additional clarifying details herein.

Transmitted Power and Signal Characteristics. ASRI seeks additional information on the transmitted signal power levels and characteristics of the Metrom system.[17] It should be noted that a complete description of the transmitted power and signal characteristics of the device are described and publicly available at the FCC website.[18] The UWB radio transmits impulse-like waveforms. The waveform is carefully shaped to use a specific frequency, in

[13] *Id*. at 3-4.

[14] *Id*. at 4; Metrom and ASRI have had a brief initial conversation and expect to continue those conversations.

[15] *Waiver Request* at 11-12.

[16] *Id*. at 11.

[17] ASRI Comments at 3.

[18] All device information can be found at the FCC website under FCC ID NUF-PSP400-A.

compliance with the Commission's UWB bandwidth requirements and the -10 dB amplitude skirts which define the UWB bandwidth.[19] Each pulse is approximately one nanosecond in length, and the pulse is repeated with a low duty cycle (approximately one percent duty cycle). Each UWB distance measurement transaction consists of the transmission of a packet by a unit mounted on a train, a few milliseconds of delay, and a responding transmission by the fixed wayside device. Each packet consists of tens of thousands of pulses, at a repetition rate of approximately 10 MHz. There is additional "off" time between the transmission of individual pulses such that the resulting duty cycle is less than one percent. Data is encoded in the pulse by using pseudo-random phase, position, and repetition rate control of the pulse train.

For transmitted power, the majority of the AURA PTC system using UWB would comply with the -41.3 dBm EIRP limits in the Commission's rules.[20] The Waiver Request seeks an allowance to transmit UWB signals at an average EIRP of no more than -35.3 dBm for those modules that require a directional antenna that would exceed the existing EIRP limit by 6 dB.[21] However, while this exceeds the UWB EIRP limits, it is consistent with the average radiated emissions generated by any other unlicensed unintentional radiator operating in frequency bands above 960 MHz. The Commission allows unintentional radiated emissions of 300 microvolts per

[19] *See* 47 C.F.R. § 15.503(a).

[20] *See* 47 C.F.R. § 15.509(d).

[21] *Waiver Request* at 16; *See also* 47 CFR § 15.519(c) (Setting the average limit measured using a resolution bandwidth of 1 MHz).

meter at 10 meters,[22] which is equivalent to an EIRP of -35.3 dBm.[23] In other words, the Waiver Request seeks an average power level for an intentional UWB transmitter at a similar power level already allowed by the Commission's regulation for any unintentional radiators. As an example, the current device is currently allowed to emit energy at this same -35.3 dBm (300 µV/m at 10 meters) average radiated emissions level when *receiving*. Moreover, the directional pattern of the antennas to be used is such that the off-axis signals (above and to the sides) will have much lower levels than indicated above, and in fact will likely be below the currently allowed limits for UWB handheld devices in most instances. The requested power level increase will only be realized for the on-axis path along the railroad track – greatly reducing any potential for harmful interference to the aviation safety services of concern to ASRI.

Finally, these UWB transmissions are not continuous. Instead, the radios on trains will be transmitting short duration packets at a rate of a few Hertz. When the transmit duty cycle is also considered, train-mounted devices will normally transmit less than 30 seconds per hour. The fixed infrastructure units will typically transmit only in response to packets sent by a particular train.

Fixed Station Installations. Fixed transmitting stations will generally be installed on either: (1) wayside signals that will be roughly 2 to 12 feet above grade; or (2) wayside structures, such as bridge walls, towers, or newly erected poles at a height of 8 to 10 feet.

[22] *See* 47 C.F.R. § 15.109(b) (Setting radiated emission limits for Class A unintentional radiators above 960 MHz).

[23] *See* 47 C.F.R. § 15.35(b) (Stating that frequencies above 960 MHz are measured using an average detector and a minimum resolution bandwidth of 1 MHz).

UWB equipment has been installed within 200 meters of the landing strip at the Whidbey Island Naval Air Station in a fixed installation under NTIA authority for the Navy, see Figure 1 below.

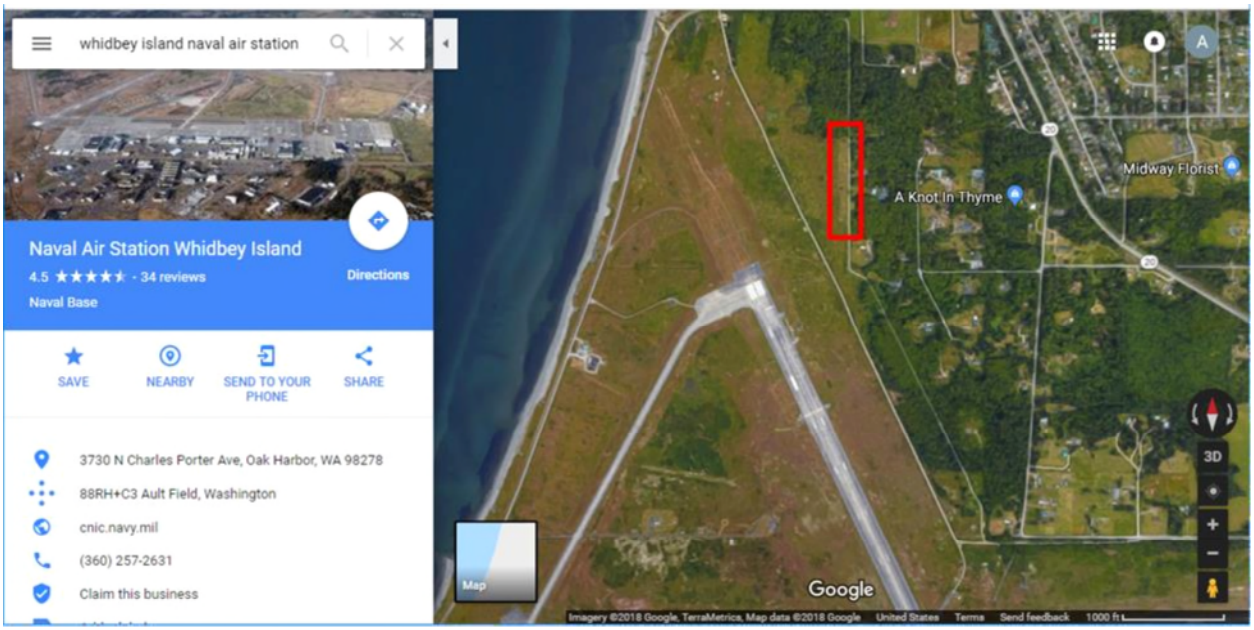

Figure 1: Whidbey Naval Air Station UWB Installation (unit locations indicated in red)

This Air Station is home to an impressive array of advanced military aircraft which actively operate from the base, and many, if not all of these aircraft use altimeters of the types described by ASRI. Thirty-six UWB devices (the same model which Metrom is proposing to use) were used at this location as an intruder detection system. These devices were mounted on poles with a maximum elevation of 3 meters. Certification information is available at the FCC website (FCC ID NUF-PSP400-A).

This system represents a much more severe operating case than the system Metrom is contemplating in this waiver. In fact, the Whidbey Island installation is likely an excellent long term, worst case, example illustrating the immunity of radar altimeters to UWB signals. This equipment was operated 24/7/365 for 5 years and monitored by the Navy. The system was

operated as a combination radar communications system such that several units were transmitting continuously at any given time. During this five-year period there were no reports of the system interfering with operation of the radar altimeters.

Density of Transmit Systems. The fixed transmitting system density is relatively low and is determined by the characteristics of the railway and the geography. In some installations, fixed transmitters will be installed at signals along the wayside. In other installations, fixed transmitters will be installed along the track at intervals such that each end of a train can reliably interact with at least two fixed transmitters ahead or behind the train, or roughly 500 to 800 feet apart. Additional fixed transmitters will be installed at the end of a track, and at each end of the stations. The fixed systems will be limited to installation along the system's tracks and the antennas will be directional, with the highest gain aligned along the track. In general, fixed transmitting systems only transmit in response to a received transmission from a mobile transmitting system. Otherwise, fixed assets are normally in receive mode and only radiating unintentional emissions.

The mobile transmitting system density varies with the train density. Each end of a train will have an active mobile transmitting system. The distance between individual trains is variable. The highest density will likely be in storage or switching yards, where trains may be positioned side-by-side and end-to-end.[24] On the main line track, the distance between trains will vary based upon either the length of the track circuit blocks, or the speed of the trains. In general, the faster the train is moving, the greater the separation will be (proportional to the square of the velocity). The distance between transmitters on a train will be dependent upon the

[24] In this condition, the UWB operating algorithm will reduce the frequency of transmissions.

length of the train. The closest operating transmitters on trains will be approximately 70 feet apart, and often will be hundreds of feet apart (as much as 500 feet).

Proximity to Airports. Both airports in New York City, John F. Kennedy International ("JFK") and LaGuardia ("LGA"), are not serviced directly by The Metropolitan Transportation Authority of New York ("MTA"), which would utilize the AURA PTC system. JFK has an AirTrain that connects to the MTA at the Jamaica-Van Wyck Subway station, which is over 4 miles from JFK. The MTA provides bus service to LGA via the 7, or Flushing Line, which is geographically the closest to LGA. The closest train stop to LGA is at 111th Street, which is over 2 miles away. In addition, approximately 60 percent of the NYC MTA is underground, greatly removing any threat of harmful interference to aviation safety services.

In Boston, the Green Line is the only location currently proposed for UWB installation. The closest Green Line stop to Boston Logan International Airport is Haymarket, which is over 2 miles away. In addition, 25 percent of the Green Line branch is underground.

Los Angeles ("LA") Metro is interested in the AURA system; however, specifics are still under discussion. The LA Metro Green Line passes the closest to Los Angeles International Airport at a distance of approximately 3500 feet to the runway. The Red and Purple Lines are below ground and account for 14 miles of the 98 total miles of service (approximately 14 percent).

The Metrom Rail system has a maximum operational distance of 1500 feet (a little more than a quarter of a mile) in ideal, outdoor conditions. This, coupled with directional antennas that concentrate RF energy down the train tracks and low transmit power levels, virtually guarantees no harmful interference to airports or known areas of aircraft operation.

Duration of Operations. The system would be operational as long as the host agency desires to operate the train control system. This could be 15 to 25 years, perhaps longer.

Use of other Chipsets/Waveforms. Metrom will not use waveforms other than what has been described above. There may be more than one data encoding technique utilized to allow more than one UWB system in use in a particular location.

Stop Buzzer Contact. These UWB devices will be installed by professional crews (not the general public). The antennas will be oriented to maintain the main beam of the antenna down the track; therefore, areas perpendicular to the tracks will likely experience emissions at Part 15-compliant levels. Fixed location devices will be deployed in documented, locations maintained by the transit authorities on transit property. Metrom agrees to provide a contact point for discussing issues which might arise in the future: Telephone 855.963.8726, email: service@metrom-rail.com.

In sum, the Waiver Request is tailored to minimize any harmful interference effects to services and has received widespread support. Metropolitan rail systems urgently require access to the Metrom solution to allow implementation of PTC for their systems. The AURA PTC system has been tested in operating environments and demonstrated to meet the needs of local rail systems without any registered harmful interference complaints. Grant of the waiver requested herein would serve the public interest by allowing a cost effective mechanism to implement safer train and transit operations. Metrom urges the Commission to expeditiously review and approve this request.

Respectfully Submitted,

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